

*Proceedings of International Conference : Problem, Solution and Development of Coastal and Delta Areas
Semarang, Indonesia – September 26th, 2017
Paper No.C-31*

The Analysis Of Risk Management Of Projects With Lumpsum Contract System and Unit Price Contract System Using AHP Method (Case Study Of Contractors In Semarang City)

Muhammad Taufik, Kartono Wibowo, Abdul Rochim
Mahasiswa Program Studi Magister Teknik Sipil Program Pascasarjana
Universitas Islam Sultan Agung
mastaopex@gmail.com

Abstract- In the construction project implementation, the contract is a bond between the project owner as the service user and the implementer / contractor as the service provider. The contract outlines the forms of cooperation, whether technical, commercial, or legal in a clear and detailed way. A fair contract should balance the rights and obligations between the two parties. So both parties should look at the articles in the contract so that the things that pose risks can be avoided. In the project implementation, the usual contracts are Lumpsum contract and Unit Price contract. The method used is Analytic Hierarchy Process (AHP) Method. The analysis process begins by defining the problem, and creating a hierarchical structure. This hierarchy consists of 3 (three) levels of objectives (level I), criteria (level II), and alternative (level III). Based on the hierarchy and then compiled questionnaires, Questionnaires were distributed to 71 respondents consisting of contractors in Semarang. The data obtained are then tabulated, followed by pairing matrices, pairing comparisons, measuring priority weights for level II and level III, and checking for consistency. This means that projects with lumpsum contracts are at higher risk of losses compared to unit price contracts. The Based on the result of cost swelling risk analysis, we get the priority weight for lumpsum contract equal to $\geq 50\%$ and contract unit price $\leq 50\%$.

Keywords: Risk, Methank, Analytic Hierarchy Process (AHP).

1. Introduction

In the implementation of the construction services project, a contract is a bond between the owner of the project as the service user with the implementer / contractor including the service provider. The contract outlines the forms of cooperation, whether technical, commercial, or legal in a clear and detailed way. A fair contract should balance the rights and obligations between the two parties. Thus, the both parties should look carefully at the articles in the contract so that the things posing a risk can be avoided.

From the contractor's perspective, the main risk that needs to be observed is the risk of the exceed cost associated with the type of contract used. The types of contracts that are often used in project execution are Lump Sum contract and Unit Price contract, so it needs to be noted further regarding to the disadvantages of the use of both types of contract related to the exceed cost they cause.

To assess the risks of these two types of contracts, the events analyzed are those that may result in exceed cost. Then compare the risk of exceed costs that rise, so the contractors can take an appropriate action when they have one type of construction contract.

In this paper, the writer tries to analyze the risk management on the project with lump sum contract system and unit price contract system. As in the implementation, the way the writer collects data is by using the Analytical Hierarchy Process (AHP) method as it is appropriate to use it as a method for solving the above problem because (1) The hierarchical structure, as a consequence of the selected criteria, to the deepest sub criteria. (2) Considering the validity to the limit of inconsistency tolerance of the various criteria

and alternatives chosen by the decision maker. (3) Considering the endurance of decision-making sensitivity analysis' output.

1.1. Management

According to experts in the Community & Library Online Indonesia (2006) a management is as follows: (1) management is a process of planning, organizing, leadership, and efforts controlling of members of the organization and use of all resources existing in the organization to achieve organizational goals set previously. (2) Management is an art, because to do a job through others requires special skills. (3) Management is an attempt to achieve a certain goal through the activities of others.

Therefore, management has an understanding as a method / technique or a process to achieve a particular goal systematically and effectively through action of Planning, Organizing (Actuating) and Controlling by using the existing resources efficiently. In addition to the management, project will also be discussed

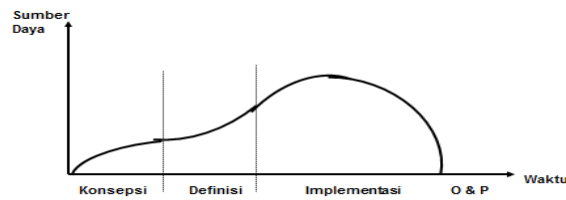
1.2. Functions of Management

Following are some of the functions of management (Teguh and Sudiadi: 2015) They are:

- 1) Planning means choosing and determining the steps of future activities which are necessary to achieve the goal. Based on this understanding. Thus, planning is meant to bridge between the goals to be achieved and the situation or the initial situation.
- 2) Organizing is how to organize and allocate activities and resources to group of participants (organization) in order to achieve goals efficiently. This means an importance to regulate the roles of each member described in the division of tasks, responsibilities, and authority. Hereinafter, organizational structure is made.
- 3) Leading means directing and influencing human resources in the organization to work voluntarily to achieve the goals outlined. Factors to note are the style of leadership that will be applied, since it is very influential on the success of the process in achieving the goal.
- 4) Controlling is to guide, in the sense of monitoring, reviewing, and if necessary making a correction for the results of activities are in accordance with the ones specified. Therefore, generally, some benchmarks, such as budget, quality standards, implementation schedule etc have been made. In case of irregularities, action of correction needs to be done immediately.

1.3. Projects

Project is a detailed or systematic effort or activity to achieve certain goals in accordance with the long term objectives (Soedarsono: 2016). The characteristics of the project include (1) Stressing on how to achieve goals in a short period of time, emphasizing more on physical activity. (2) Non repetitive activities, not a routine. (3) Activities run through a cycle of stages; each stage requires special and varied resources. The following is an image of the project stages:



Picture 1. Stages of Projects

Source: Iman Soeharto, 1993 in (Soedarsono:2016)

The process can be interpreted as "Science and art related to leading and coordinating human and material resources by using modern management techniques to achieve predetermined targets, namely: scope, quality, schedule, and cost, and then meet the interests of stakeholders".

In principle, project management is: the implementation of knowledge, skills of "tools and techniques" on the project activities so that the requirements and project needs are met. Project management processes are grouped into 5. They are:

- Initiation process
- Planning process
- Executing process
- Controlling process
- Closing process

1.4. Risk Management

In every business activity including the construction services business, there will always appear two possibilities which are the opportunity to earn profits and risks of loss, either directly or indirectly. In simple terms, risk means the possibility of adverse events to happen. In the perspective of contractor, risk is the possibility of occurrence of events in the business process, which may adversely affect the achievement of defined business goals (Asiyanto, 2005).

Risk should only be taken whenever the potential benefits and the possibility of success are greater than the costs required to cover up the possible failures. In relation to the project, the risk can be interpreted as a cumulative impact of the occurrence of uncertainty that negatively impacts the project objectives (Suharto, 2001).

Risk management means a process of measuring and controlling the risks that are likely to occur to a particular construction business activity. In risk management some types of decision-making are required. The image below compares the probability of an event with its effect.



Picture 2. Level of Risk Clarification

(Source: Smith, 1999)

1.5. Contract

A contract is an agreement between the service user and the service provider to perform a transaction between the service provider and the user, with a certain amount of money as a result of negotiation between the two parties. In this case the contract must have two main aspects: mutual approval, and supply and acceptance (Sutadi, 2005).

1.6. Lump Sum Contract

In general (worldwide), the Fixed Lump Sum Price contract is a contract where the volume of work contained in the contract should not be re-measured or in English “A Fixed Lump Sum Price Contract is a contract where the Bill of Quantity is not subject to re-measurement”(Nazarkhan Yasin, 2014)

Factors that change the work of lump sum contract, fidic silver book include (1) Geotechnical (2) Hydrology (3) Social Environment (4) Public Authority Demands (5) Change Instruction. The Contractor with all its competence is unable to anticipate the factors mentioned above at the time of Pre-Offer period until Bidding period. Contractors receive the changes. However, the slightest change will affect the Cost (Dono Parwoto, 2014).

The Lumpsum Contract has to be applied in accordance with its operation under the applicable Terms and Conditions, not based on subject to the interest of any party. If there is a change of image and specification, then Lump Sum Contracts Changed to Lump Sum (Dono Parwoto, 2014).

1.7. Unit Price Contract

In general, Unit Price contracts are contracts in which the volume of work listed in the new contract is an estimate and will be re-measured together with the service user and the service provider to determine the volume of work that is performed or: "A Unit Price Contract is a contract where the Bill of Quantity is subject to re-measurement"(Nazarkhan Yasin, 2014).

2. Method

Research Methods is a set of steps that must be done and arranged systematically while doing a research study. Stages in the method of study are conducted to obtain the desired, qualified, effective and efficient results that support the whole of the reporting process of this research. This thesis aims to Measure the level of risk that will be experienced by the owner or contractor with the Analytical Hierarchy Process (AHP) method.

The method used is the Analytical Hierarchy Process (AHP) method. This method makes an assessment of the importance between decision alternatives under certain criteria, so it is obtained the scoring of each alternative by using certain scales. The steps in the AHP method are (Okka Suputra.dkk, 2009):

1. Define what problems that are not in accordance with the plan.
2. Create a hierarchical structure that begins with a general purpose, followed by subprojects, criteria and possible alternatives at the bottom of the criterion.
3. Collect data by making a questionnaire based on a hierarchical structure, then tabulated for an easy data processing later.
4. Create a matched comparison matrix by describing the relative contribution or influence of each element on each of objectives / criteria that is one level higher of the element. Comparison made is based on the judgment of the decision maker by assessing the level of importance of an element compared to other elements.
5. Perform pairwise comparisons so that the overall judgment is obtained as much as $n \times \{(n-1) / 2\}$, where n is the comparable element.

6. After the comparison matrix for a group of elements is completed then the next step is to measure the priority weight of each element.
7. Check the consistency of the hierarchy. If the value is greater than 10% then the assessment of data judgment must be improved by performing normalization then again performing the steps 5 and 6 until the value $\leq 10\%$ is obtained.

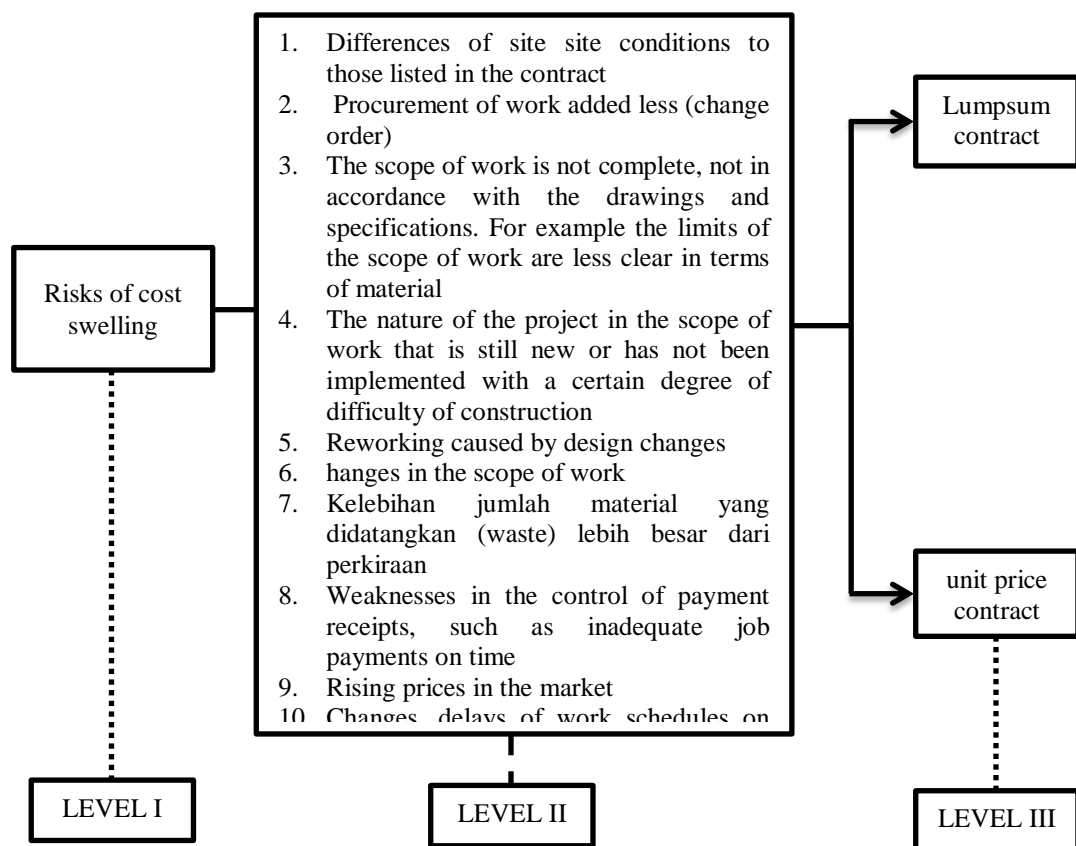
3. Result and Discussion

3.1. Result

After processing and analysis of data, will be obtained in the form of ranking / list of priority weighting of the scoring results against the criteria and subcriteria that already exist. Based on the priority weight of each criterion and subcriteria, the comparison of project risk based on the type of contract used is lumpsum contract and unit price contract.

3.2. Structure of the Cost Swelling Hierarchy

Based on the result of identification of cost swelling risk criteria on lumpsum contract and unit price contract, can be arranged hierarchical structure of risk of swelling cost as in Figure 1



Benefits by Contract Type and Project Type The calculation in Questionnaire I was conducted by summarizing opinion 1. expert respondents on the project which on average provide benefits based on the type of contract and type of project, can be seen in Table 1.

Table 1. Benefits by type of contract and type of project K

Respondents	Criteria					
	Lumpsum			Unit price		
	Street	Building	Dam	Street	Building	Dam
Number of respondents who choose	2	9	2	29	21	8
Total	71					
Percentage (%)	2.82	12.68	2.82	40.85	29.58	11.27
Total percentage	18.31			81.69		

Based on Table 4, it can be interpreted that the type of unit price contract is more profitable than the lumpsum contract and based on the type of project 75% of respondents said the road project is more profitable. Calculation of Weighted Risk Criteria Score Criteria The results of the data in Questionnaire II were analyzed by Analytic Hierarchy Process method to obtain the weight of each criterion that will be used to find the level / priority of the risk that most cause the cost swelling on the contract of lumpsum and unit price contract with step- steps like Table.

Calculation of Weight of Risk Criteria of Cost Swelling

1. Differences of site site conditions to those listed in the contract
2. Procurement of work added less (change order)
3. The scope of work is not complete, not in accordance with the drawings and specifications. For example the limits of the scope of work are less clear in terms of material
4. The nature of the project in the scope of work that is still new or has not been implemented with a certain degree of difficulty of construction.
5. Reworking caused by design changes.
6. Changes in the scope of work.
7. Excess amount of material imported (waste) is greater than expected.
8. Weaknesses in the control of payment receipts, such as inadequate job payments on time.
9. Rising prices in the market
- 10.Changes, delays of work schedules on request or owner interruptions

Table 2. Weighting Risk Criteria For Cost Swelling

No.	Criteria	Value
1.	Differences of site site conditions to those listed in the contract	0,18
2.	Procurement of work added less (change order)	0,07
3.	Incomplete work scope, not in accordance with drawings and specifications. For example the limits of the scope of work are less clear in terms of material	0,18
4.	The nature of the project in the scope of work is still new or has never been implemented with a certain degree of difficulty of construction	0,09
5.	Reworking caused by design changes	0,12
6.	Changes in the scope of work	0,08
7.	Excess amount of material imported (waste) is greater than expected	0,07
8.	Weaknesses in the control of payment receipts, such as improper job payments in time	0.04
9.	Rising prices in the market	0.10
10.	Changes, work schedule delays upon request or owner interruption	0.04
11.	Total	1

Based on Table 2 it is found that the criteria of the scope of work are incomplete, not in accordance with the drawings and specifications. For example the limits of the scope of work that is less clear in terms of material more influence on the risk of swelling costs because it has the greatest weight of 20% while the change criteria, delaying the work schedule on demand or interrupt owner gives the least effect on the risk of cost swelling that is 4 %.

4. Conclusion and Suggestion

4.1. Conclusion

Based on the above data analysis can be concluded as follows:

1. From the questionnaire data obtained the fact that 81.69% of respondents said the project with unit price contract is more profitable in terms of risk level compared to the contract lumpsum.
2. The result of analysis with AHP method, it is found that the risk ratio from the cost aspect of lumpsum contract is higher than the unit price contract.
3. Of the ten risk swelling events reviewed, there are 2 (two) dominant risks, namely:
 - a. The scope of work is not complete, not in accordance with the drawings and specifications, such as the limits of the scope of work that is less clear in terms of material.
 - b. Differences of site site conditions to those listed in the contract
4. All risk events reviewed in the Lumpsum contract have a greater priority weight than the unit price contract, which means that the risk of cost swelling in the lumpsum contract is much higher than the unit price contract

4.2. Suggestion

1. From at the conclusion that lumpsum contracts are more at risk of losses than unit-price contracts, it is recommended that contractors be more careful to address the risk events reviewed above on projects with lumpsum contracts.
2. Contractor to better observe the dominant risks identified in this study by preparing mitigation actions to reduce the consequences of possible cost swelling risks.

5. References

- Agung Triyoso, 2016, *Manajemen risiko kontrak konstruksi pada sistem unit price terhadap proyek pembangunan fly over jalan juanda-abdul wahab syahrani di samarinda*, Jurnal Jurusan Teknik Sipil Fakultas Teknik Universitas 17 Agustus 1945 Samarinda
- Agung Triyoso, 2016, *Manajemen Risiko Kontrak Konstruksi Pada Sistem Unit Price Terhadap Proyek Pembangunan Fly Over Jalan Juanda-Abdul Wahab Syahrani Di Samarinda*. Jurnal Teknik sipil Universitas 17 Agustus 1945 Samarinda
- Andi Setiawan, dkk., 2014, *Analisis manajemen risiko pada proyek pembangunan jalan tol cisumdawu (studi kasus: development of Cileunyi-Sumedang dawuan toll road phase i)*Jurnal STT-Garut All Right Reserved.
- Asiyanto, 2005, *Manajemen Produksi Untuk Jasa Konstruksi*, Pradnya Paramita, Jakarta.
- Burhan Bungin, 2014, *Metodologi Penelitian Kuantitatif*. Jakarta:Kencana Prenamedia Group.

- Dono Parwoto, 2014, *Permasalahan Klaim Pada Proyek Sektor Swasta Terkait Jenis Kontrak Lump Sum Dari Sudut Pandang Kontraktor*, Diktat Seminar Nasional 2014 Manajemen Klaim Proyek Konstruksi
- Heru Bawono, dkk, 2013, *Analisis perbandingan risiko kontrak lumpsum dan kontrak unit price (Studi kasus kontraktor di kota Samarinda Kalimantan timur)* Jurnal rekayasa Sipil/ Volume 7, No.2-2013 ISSN 1978-5658.
- I Gusti Ngurah Oka Suputra, dkk, 2008, *Analisis perbandingan risiko biaya antara kontrak lumpsum dengan kontrak unit price menggunakan metode decision tree*, Jurnal Ilmiah Teknik Sipil Vol. 12, No. 2, Juli 2008
- I Gusti Ngurah Oka Suputra, dkk. 2009, *Analisis perbandingan risiko biaya kontrak lumpsum dan Kontrak unit price dengan metode AHP (Studi Kasus Kontraktor Di Kota Denpasar)* Jurnal Ilmiah Teknik Sipil Vol. 13, No. 1, Januari 2009.
- Nazarkhan Yasin, 2014 *Mengenal Kontrak Konstruksi Di Indonesia*, PT. Gramedia Pustaka Utama, Jakarta.
- Soedarsono, 2016, *Aspek Hukum & Administrasi Proyek*, Diktat Matakuliah Magister Teknik Sipil UNISSULA
- Soeharto, 2001, *Manajemen Proyek Jilid 2 (Dari Konseptual Sampai Operasional)*, Erlangga, Jakarta.